

Claims:

1. A process for coating a material surface comprising the steps of:
 - (a) applying to the material surface one or more different comb-type polymers comprising a polymer backbone and side chains pendently attached thereto, wherein at least a part of the side chains carry a triggerable precursor for carbene or nitrene formation; and
 - (b) fixing the polymer(s) onto the material surface using heat or radiation, in particular radiation such as UV or visible light.

2. A process according to claim 1, wherein the polymer backbone according to step (a) of the process comprises a polyvinyl homo- or copolymer, a polyethylene imine, a polypeptide, a polyether or a polysaccharide, and the side chains that are attached to the polymer backbone are selected from the group consisting of functional hydrophilic telomers, polyalkylene oxides, oligosaccharides and oligopeptides.

3. A process according to claim 1 or 2, wherein the comb-type polymer according to step (a) of the process is
 - (I) a polyvinyl polymer comprising units of the formula



wherein R is hydrogen or C₁-C₄-alkyl and Z₁ is a hydrophilic side chain comprising at least one one triggerable precursor for carbene or nitrene formation and having a weight average molecular weight of ≥ 200 ; or

- (II) a polyethylene imine comprising units of formula



wherein Z_2 is a hydrophilic side chain comprising at least one triggerable precursor for carbene or nitrene formation and having a weight average molecular weight of ≥ 200 ; or
 (III) a polypeptide comprising units of formula

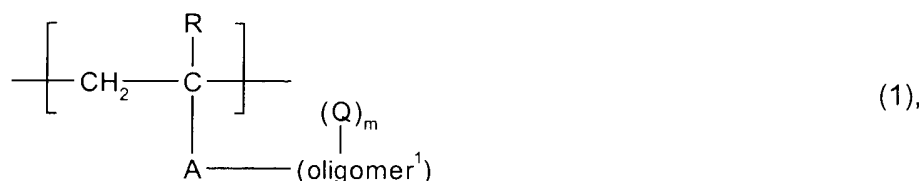


wherein Z_3 is a hydrophilic side chain comprising at least one triggerable precursor for carbene or nitrene formation and having a weight average molecular weight of ≥ 200 ; or
 (IV) a polyether comprising units of formula



wherein Z_4 is a hydrophilic side chain comprising at least one triggerable precursor for carbene or nitrene formation and having a weight average molecular weight of ≥ 200 , or
 (V) a polysaccharide comprising saccharide units to which is attached a side chain Z_5 comprising at least one triggerable precursor for carbene or nitrene formation and having a weight average molecular weight of ≥ 200 .

4. A process according to any one of claims 1 to 3, wherein the comb-type polymer according to step (a) comprises units of formula



wherein R is hydrogen or C_1 - C_4 -alkyl;

- A is a radical of formula
- $\text{C(O)} - \text{X} -$ (2a),
 - $\text{C(O)} - \text{O} - (\text{CH}_2)_r - \text{CH(OH)} - \text{CH}_2 - \text{X} -$ (2b),
 - $\text{C(O)} - \text{NH} - (\text{alk}') - \text{C(O)} - \text{X} -$ (2c),
 - $\text{C(O)} - \text{O} - (\text{alk}'') - \text{NH} - \text{C(O)} - \text{X} -$ (2d),
 - $\text{C(O)} - \text{X} - (\text{alk}'') - \text{X}_1 - \text{C(O)} -$ (2e),
 - $\text{C(O)} - \text{NH} - \text{C(O)} - \text{X} -$ (2f),
 - $(\text{alk}''')_s - \text{X} - \text{D} - \text{X}_1 -$ (2g)
 - $\text{X} - (\text{alk}') - \text{X}_1 -$ (2h),



wherein (alk') is C₁-C₆-alkylene; (alk'') is C₂-C₁₂-alkylene; (alk''') is C₁-C₆-alkylene; D is a group -C(O)- or -C(S)- and s is 0 or 1;

X and X₁ are each independently a group -O- or -NR₁-, wherein R₁ is hydrogen or C₁-C₄-alkyl;

(oligomer¹) is the radical of

(i) a hydrophilic telomer which is derived from one or more different copolymerizable vinyl monomers,

(ii) the radical of an oligosaccharide;

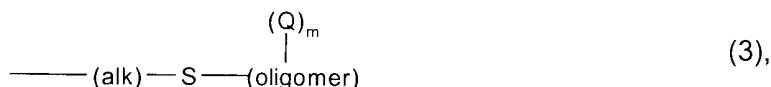
(iii) the radical of an oligopeptide; or

(iv) the radical of a polyalkylene oxide;

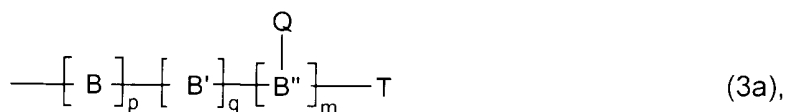
Q is a radical comprising a triggerable precursor for carbene or nitrene formation;

r is an integer from 1 to 4; and m is an integer ≥ 1 .

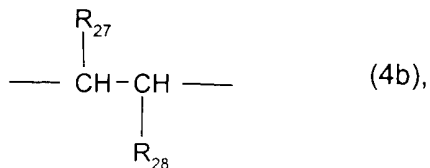
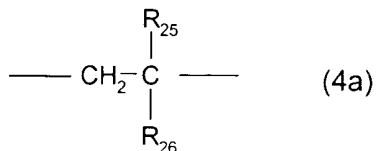
5. A process according to claim 4, wherein the radical -(oligomer¹)-(Q)_m corresponds to a radical of formula



wherein (alk) is C₂-C₆-alkylene and (oligomer)-(Q)_m corresponds to formula

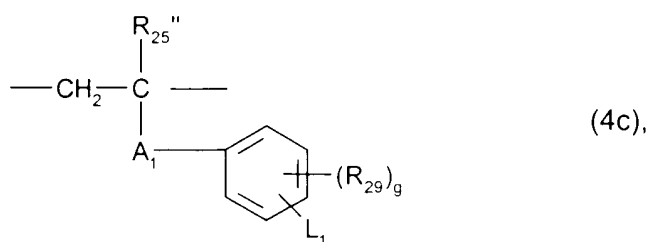


wherein B and B' are each independently of the other a radical of formula



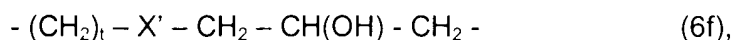
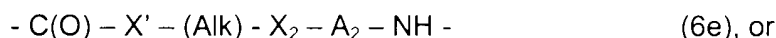
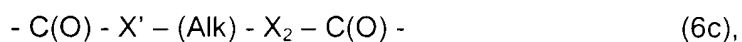
wherein R₂₅ is hydrogen or C₁-C₄-alkyl, R₂₆ is a hydrophilic substituent; R₂₇ is C₁-C₄-alkyl, phenyl or a radical -C(O)OY₉, wherein Y₉ is hydrogen or unsubstituted or hydroxy-substituted C₁-C₄-alkyl; and R₂₈ is a radical -C(O)OY₉' or -CH₂-C(O)OY₉' wherein Y₉' independently has the meaning of Y₉;

B''-Q is a 1,2-ethylene radical of formula



wherein R_{25}'' is hydrogen or $\text{C}_1\text{-C}_4$ -alkyl,

A_1 is a linking member of formula

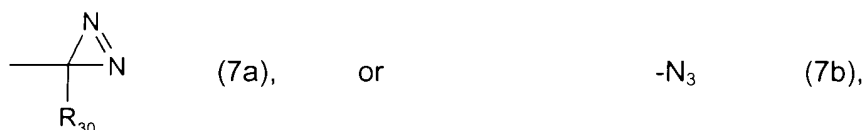


X' and X_2 are each independently a group $-\text{O}-$ or $-\text{NR}_1'-$, R_1' is hydrogen or $\text{C}_1\text{-C}_4$ -alkyl; D_1 is a group $-\text{C(O)}-$ or $-\text{C(S)}-$, (Alk) is $\text{C}_2\text{-C}_{12}$ -alkylene, t is 0 or 1,

R_{29} is $\text{C}_1\text{-C}_4$ -alkyl, $\text{C}_1\text{-C}_4$ -alkoxy, amino, hydroxy, sulfo, nitro, trifluoromethyl or halogen,

g is an integer from 0 to 2,

L_1 is a group of formula

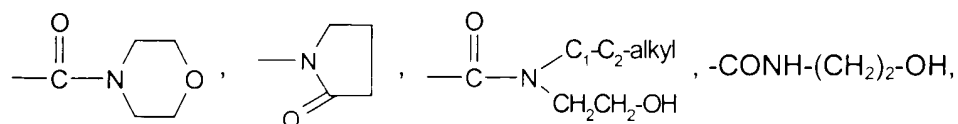


R_{30} is fluorinated $\text{C}_1\text{-C}_6$ -alkyl,

p and q are each independently of another an integer from 0 to 250, wherein the total of $(p+q)$ is an integer from 2 to 250, m is an integer from 1 to 3, and

T is a monovalent group that is suitable to act as a polymerization chain-reaction terminator.

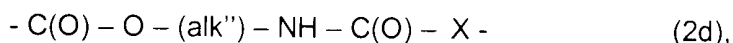
6. A process according to claim 5, wherein B and B' are each independently a radical of formula (4a), R_{25} is hydrogen or methyl, and R_{26} is a radical $-\text{CONH}_2$, $-\text{CON}(\text{CH}_3)_2$,



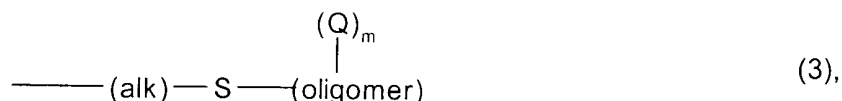
$-\text{COO}(\text{CH}_2)_{2-4}\text{-NHC(O)-O-G}$, wherein $-\text{O-G}$ is the radical of trehalose, $-\text{COOH}$, $-\text{NH}_2$, $-\text{CH}_2\text{-NH}_2$, $-\text{CH}_2\text{-N}(\text{CH}_3)_2$, $-\text{C(O)NH}-(\text{CH}_2)_{2-3}\text{-NH}_2$, $-\text{C(O)O}-(\text{CH}_2)_{2-3}\text{-NH}_2$,

$-\text{COO}-(\text{CH}_2)_2-\text{N}(\text{CH}_3)_2$ or $-\text{C}(\text{O})\text{O}-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-\text{N}(\text{CH}_3)_3^+\text{An}^-$, wherein An^- is an anion.

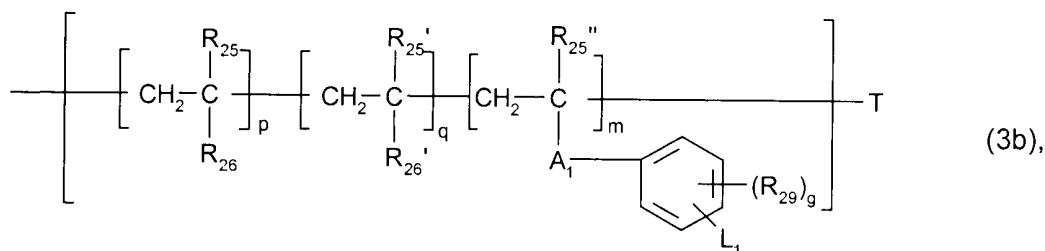
7. A process according to any one of claims 4 to 6, wherein in the polymer units of formula (1) R is hydrogen or methyl, A is a radical of formula



(alk') is C_2 - C_4 -alkylene; X is $-\text{NH}-$; and (oligomer')-(Q)_m is a telomer radical of formula



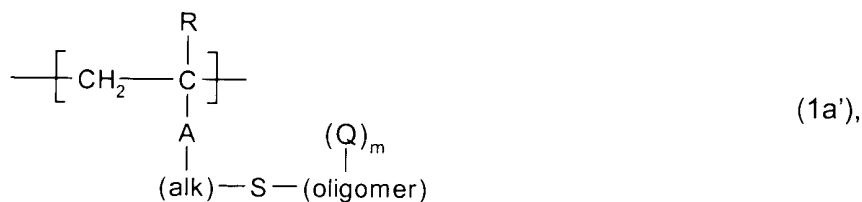
wherein (alk) is C_2 - C_4 -alkylene and (oligomer)-(Q)_m corresponds to formula



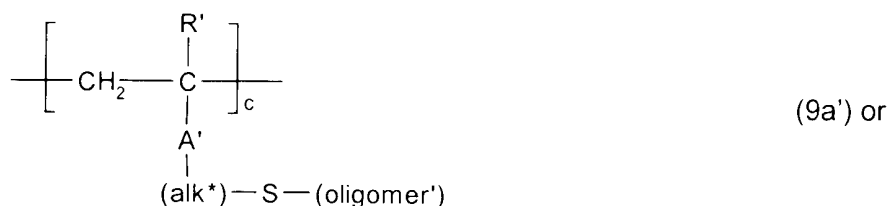
wherein R_{25} , R_{25}' and R_{25}'' are each independently hydrogen or methyl, R_{26} is a radical $-\text{CONH}_2$, $-\text{CON}(\text{CH}_3)_2$ or N-pyrrolidonyl, R_{26}' is $-\text{NH}_2$ or $-\text{C}(\text{O})\text{X}'-(\text{Alk})-\text{NH}_2$, X' is $-\text{O}-$ or $-\text{NH}-$, (Alk) is C_2 - C_3 -alkylene, A_1 is a radical $-\text{NH}-\text{C}(\text{O})-$ or $-\text{C}(\text{O})-\text{NH}-(\text{CH}_2)_{2-4}-\text{NH}-\text{C}(\text{O})-$, g is 0, L_1 is a radical $\text{CF}_3-\text{N}=\text{N}-$ or $-\text{N}_3$, p and q are each independently an integer from 0 to 150,

wherein the total of (p+q) is an integer from 2 to 150, m is an integer from 1 to 3, and T is a monovalent group that is suitable to act as a polymerization chain-reaction terminator.

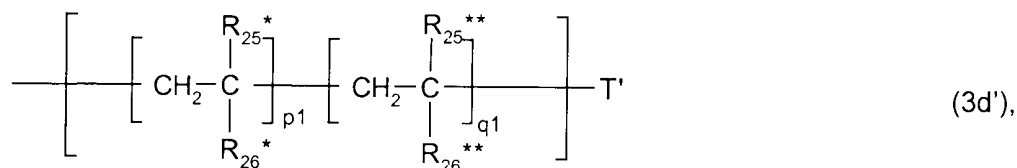
8. A process according to any one of claims 1 to 7, wherein the comb-type polymer according to step (a) is a polymer comprising units of formula



and optionally



wherein R, R' and R_{25a} are each independently hydrogen or methyl, R_{26a} is a radical -CONH₂, -CON(CH₃)₂ or N-pyrrolidonyl, A and A' are each independently a radical of the above formula (2a), (2c), (2d), (2i) or (2k) given in claim 4, wherein X is a group -O- or -NH-, (alk)'' is C₂-C₄-alkylene, (alk') is a radical -CH₂- or -C(CH₃)₂-, and (alk''') is C₁-C₂-alkylene, (alk) and (alk*) are each independently C₂-C₄-alkylene, (oligomer)-(Q)_m is a radical of formula (3b) according to claim 7, and (oligomer') is a radical of formula



wherein R₂₅^{*} and R₂₅^{**} are each independently hydrogen or methyl, R₂₆^{*} and R₂₆^{**} are each independently a radical -CONH₂, -CON(CH₃)₂ or N-pyrrolidonyl, p₁ and q₁ are each independently an integer of from 0 to 150 and the total of (p₁+q₁) is an integer from 2 to 150, and T' is a monovalent group that is suitable to act as a polymerization chain-reaction terminator.

9. A process according to claim 8, wherein the comb-type polymer according to step (a) essentially consists of units of formula (1a').

10. A process according to claim 8, wherein the comb-type polymer according to step (a) essentially consists of units of formula (1a') and optionally (9a').

11. A process according to any one of claims 1 to 10, wherein the material surface to be coated is the surface of a biomedical device, particularly a contact lens, intraocular lens or artificial cornea.

12. A composite material comprising

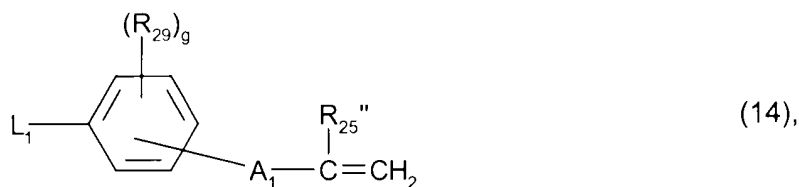
(i) an inorganic or organic bulk material; and

(ii) a hydrophilic surface coating obtainable by the process according to any one of claims 1 to 11.

13. Use of a comb-type polymer comprising a polymer backbone and side chains pendently attached thereto, wherein at least a part of the side chains carry a triggerable precursor for carbene or nitrene formation for the modification of a material surface, in particular of a surface of a biomedical article.

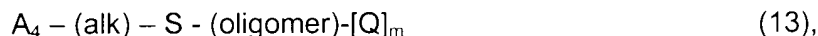
14. A polymer comprising units of formula (1a), (1b), (1c) or (1d) according to claim 3.

15. A compound of formula

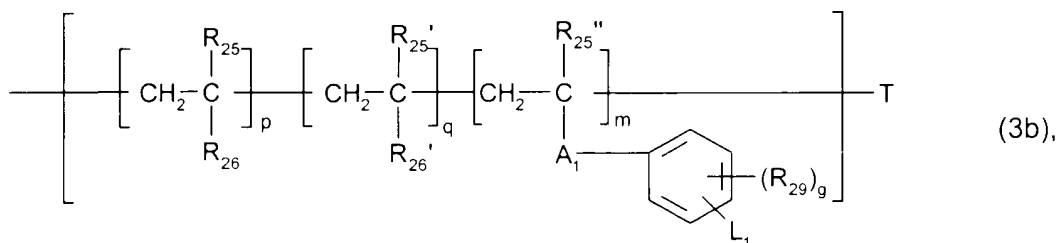


wherein A_1 , L_1 , R_{25}'' , R_{29} and g are each as defined in claim 5.

16. A telomer of formula



wherein A_4 is hydroxy, amino, carboxy or a derivative thereof, (alk) is C_2 - C_6 -alkylene, and (oligomer)- $[Q]_m$ is a radical of formula

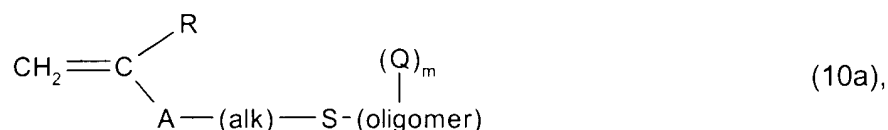


wherein R_{25} , R_{25}' and R_{25}'' are each independently hydrogen or C_1 - C_4 -alkyl, R_{26} and R_{26}' are each independently a hydrophilic substituent,

p and q are each independently of another an integer from 0 to 250, wherein the total of $(p+q)$ is an integer from 2 to 250, m is an integer ≥ 1 ,

T is a monovalent group that is suitable to act as a polymerization chain-reaction terminator, and R_{25}'' , R_{29} , A_1 , L_1 and g are each as defined in claim 5.

17. A macromonomer of formula



wherein R is hydrogen or C_1 - C_4 -alkyl, (alk) is C_2 - C_6 -alkylene, A is a radical of formula (2a) – (2k) given in claim 4, and $(\text{oligomer})-(\text{Q})_m$ is a radical of formula (3b) given in claim 16.

18. A biomedical article, particularly a contact lens, intraocular lens or artificial cornea, comprising a surface coating that is obtainable by fixing a polymer according to claim 14 onto its surface by the action of heat or radiation.